Method and Apparatus for Regulating Power to a Heating Element Surrounding a Freezer Door

The present invention relates to reducing the power drawn by a refrigerator-freezer or the like having a freezer access door and/or an ice dispenser door, and a heating element for preventing the freezer access door and/or the ice dispensing door from being froze to its frame by providing a controller for regulating the application of power to a heater for heating the door or door frame in response to a humidity sensor.

Background of the Invention

Many refrigerator-freezers manufactured and sold for home use have built into the door enclosing the freezer compartment, an ice dispenser for dispensing ice into drinking glasses. Typically, such refrigerators are constructed in side by side fashion, with the freezer compartment constituting approximately forty percent of the unit and the refrigerator compartment the remaining sixty percent of the unit.

Moisture sometimes accumulates around the door to the freezer compartment and if moisture between the freezer door and the contact surfaces of the freezer becomes frozen, the freezer door can become frozen shut. To prevent the freezer door from becoming frozen shut, it is the practice to provide a heating element around the perimeter of the access door, or around the contact surfaces of the freezer body to heat the contact surfaces above freezing temperature. For freezers having an icemaker, the icemaker is positioned inside the freezer compartment. The icemaker freezes water and separates the ice into individual chunks or cubes, and the cubes are retained in a retainer for dispensing. A dispensing door separates the freezer compartment from the

ambient and a spring urges the ice dispensing door to the closed position. The weight and pressure of the ice against the inner surface of the door forces the door open when the ice dispenser is in operation.

Like the door to the freezer, the dispenser door that closes the ice dispensing unit from the ambient may become frozen to its door frame, thereby preventing or interfering with the dispensing of ice. To prevent the dispensing door from becoming frozen to the frame, a heating element is also provided in either the door or the frame to heat the contact surfaces to a temperature at which freezing will not occur. In order to ensure that the above described doors do not become frozen to their door frames, power is continuously applied to the heating elements and the power drawn to heat the contact surfaces between the doors and their frames add significantly to the cost of operating the unit. It would be desirable, therefore, to provide a means for reducing the power needed to heat the contact surfaces between the various doors and the door frames of a freezer, and thereby reduce the amount of power drawn by the refrigerator-freezer unit.

Summary of the Invention

Briefly, the present invention is embodied in a refrigerator-freezer that includes a freezer unit having a freezer door and also having an ice dispensing for dispensing ice outside of the freezer unit. The freezer door has a heating element that extends adjacent the contact surface surrounding either the door or the doorframe to heat the contact surfaces and prevent the door from becoming frozen shut.

In similar fashion, the ice dispensing unit has a dispensing door that is closeable against a dispensing door frame for separating the interior of the freezer enclosure from

the ambient, and a heating element in one of the dispensing door and the dispensing door frame for preventing the freezing of the door to the frame. This heating element, like the one surrounding the access door to the freezer, is connected to a power source.

I have found that the freezing of a freezer access door or an ice dispenser door into its associated frame tends to occur when the humidity of the ambient is above a given threshold, namely, about 60 percent. When the humidity is below the threshold, moisture in the general vicinity of a freezer door will evaporate and the ice dispensing door will not freeze to the frame. On the other hand, when the humidity is above the threshold, moisture will not evaporate from around the door and the door will become frozen to the adjacent frame unless heat is applied to the contact surfaces between the door and the frame. The method of the invention, therefore, includes a switch between each heating element that applies heat to the contact surfaces surrounding a freezer door and the power source, and a sensor for sensing the humidity of the ambient. A controller is provided that is responsive to the sensor and opens one or more switches when the sensor detects that the humidity of the ambient has fallen below the threshold and closes the switches when the sensor senses that the humidity has risen above the threshold.

In accordance with the invention, a switch is provided between the power source and each of the heating elements such that opening the switch will prevent the application of power to the associated heating element and closing of the switch will apply power to the associated heating element. A sensor is also provided for sensing the humidity of the ambient and a controller is provided which is responsive to the sensor. The controller will open each of the two switches when the humidity of the

ambient is below a given threshold and will close the two switches when the sensor senses the humidity of the ambient which is above the given threshold. It should be appreciated that although the invention has been described as responding to a single humidity threshold, the system could provide a first threshold for the heating element surrounding the access door to the freezer, and a second threshold for the heating element around the ice dispensing door.

Brief Description of the Drawings

A better understanding of the present invention will be had after a reading of the following detailed description taken in conjunction with drawings wherein:

Fig. 1 is a front view of a refrigerator-freezer having an ice dispenser therein;

Fig. 2 is a fragmentary cross-sectional view of the freezer compartment of the refrigerator-freezer shown if Fig. 1 taken through lines 2 –2 thereof;

Fig. 3 is a fragmentary cross-sectional view the access door to the freezer compartment show in fig. 3 taken through line 3 – 3 thereof and showing the ice dispenser door and door frame separating the interior of the freezer from the ambient; and

Fig. 4 is a block diagram showing the elements of the invention.

Detailed Description of a Preferred Embodiment

Referring to Figs. 1 and 2, a side by side refrigerator-freezer 10 includes a refrigerator compartment having a refrigerator access door 12 which occupies approximately sixty percent of the forward surface of the refrigerator-freezer 10, and a

freezer compartment access door 14 which occupies the remaining forty percent of the forward surface of the refrigerator-freezer 10. The doors 12, 14 are vertically oriented and positioned approximately half up the freezer door 14 is an indentation 16 for receiving the glass of a user seeking to have water or ice dispensed therein. At the upper surface of the indentation 16 is a spout 18 for dispensing water and an ice dispensing door 20. A switch 22 beneath the spout 18 operates a controller for the dispensing of water through the spout 18. A second switch 24 beneath the ice dispensing door 20 initiates an ice dispensing sequence in which ice is dispensed through a chute and against the ice dispensing door 20 forcing the door open against a return spring, not shown, such that the ice cubes fall into the user's glass.

Referring to Fig. 2, the body 25 of the refrigerator-freezer unit 10 includes a freezer compartment 26 the forward opening of which is closed off by the freezer compartment access door 14. Surrounding the forward opening of the freezer compartment 26 so as to be contacted by the peripheral edge of the door 14 is a seal 27, and adjacent the seal 27 if a heating element 28 for preventing the formation of ice between the contact surfaces of the access door 14 and the compartment 26. It should be appreciated that although the heating element 28 is depicted as being positioned in the compartment 26, it could be positioned in the door adjacent the contact portions thereof.

Inside the freezer compartment 26 is an icemaker 29. Ice formed in the icemaker 29 is stored in a retainer 30, and extending into the retainer 30 is a dispensing mechanism 32. When the switch for dispensing ice 24 is operated, a motor will operate the dispensing mechanism 32 and dispense chunks or cubes of ice from the retainer 30

through the ice dispensing door 20 to a user's glass below. When the glass is removed from the indentation 16 and the switch 24 is opened, the door 20 will close and power to the dispensing mechanism 32 will be terminated.

Referring to Fig. 3, the ice dispensing door 20 opens by pivoting about a hinge 33. The ice dispensing door 20 is urged into the closed position by a spring, not shown, and is opened by the weight of the ice cubes applied to the inner upper surface of the ice dispensing door 20. Surrounding the ice dispensing door 20 is a doorframe 34. Positioned near the contact surfaces between the door frame 34 and the ice dispensing door 20 is a heating element 40 for heating the contact surfaces and preventing ice from forming between the contact surfaces and thereby interfering with the opening and closing of the ice dispensing door 20.

Referring to Fig. 1 and 4, in accordance with the present invention, the heating element 28 is connected to an A/C power source 41 through a first switch 43 and heating element 40 is connected to the A/C power source through a second switch 44. Both switches 43, 44 are operated by controller 46. Connected to the controller 46 is a humidity sensor 48 for sensing the humidity of ambient air. Preferably, the sensor 48 is positioned outside the freezer body 25 and unside the skin of the freezer door 14, near the ice dispensing door 20.

In accordance with the invention, the controller 46 will open the switches 43 and 44 and prevent power from a power source 41 from being applied to the heating elements 28, 40 when the controller determines that the humidity being sensed by the sensor 48 is below a given threshold and will close the switches 43, 44 and apply A/C power from the power source 41 to the heating elements 28, 40 when the controller 46

determines that the sensor 48 is detecting a humidity above the given threshold. I have determined that a useful threshold nominal humidity is sixty percent for all practical purposes, and that the freezer doors 14, 20 will not freeze against the doorframes 28, 34 where the ambient humidity is above sixty percent.

By controlling the application of power from the power source 41 to the heating elements 28, 40, the heating elements 28, 40 will only draw power when the ambient humidity is above the threshold level. By controlling the application of power to the heating elements 28, 40, the amount of energy drawn by the refrigerator-freezer unit 10 is significantly reduced, thereby reducing the cost of operation of the refrigerator-freezer 10 and improving its efficiency.

While the present invention has been described with respect to a single embodiment, it will be appreciated that many modifications and variations may be made without departing from the true spirit and scope of the invention. It is therefore the intent of the appendent claims to cover all such variations and modifications that fall within the spirit of the invention.